Universidad de SanAndrés

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Licenciatura en Economía

Sectoral Productivity and Structural Transformation in Developing Countries; from Agriculture to Manufacturing?

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Abstract

In this work we analyze the stylized facts of structural transformation, for developing countries as well as for developed ones. We also study the developing countries and their patterns of structural transformation for the period spanning from 1990-2018. After that we review the literature on structural transformation to answer whether the manufacturing sector is still the optimal path for developing countries to focus on to achieve modern economic growth.

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Introduction

There are some noticeable symptoms in a country experiencing modern economic growth. As Kuznets (1973) noted, the per capita product of the economy continuously grows at high rates, its labor force productivity experiences a high rate of growth as well. Because of the changing productivity of some sectors, the economy too has an accelerated rate of change in its sectoral composition; it shifts away from agriculture to more productive sectors in order to arbitrage the differences in sectoral productivity. This is to say that the more developed an economy is, the smaller the gaps in marginal productivity amongst its sectors (in the absence of any positive or negative productivity shocks in any specific sector).

With the dropping costs in transport and communication, a higher rate of integration of the global economy becomes a reality. The countries which open themselves up to the global economy will experience some form of structural transformation, still, whether this transformation leads them to modern economic growth depends on their political frame and capacity to exploit the potential of the technical advancements available.

The countries that want to converge to the frontier levels of development by taking advantage of the already existing technical advancements and turning them into a pathway to modern economic growth, will find that it requires the capability to change the underlying production structure of the economy while being able to maintain the political fabric of the society that makes up their economy.

This is because modern economic growth, with its technological advancements, inevitably brings a change in relative productivity of the different groups in society and thus changes the relative position of one group over the other. While it is not a zero-sum game in absolute terms, because everyone should be better than before, in relative terms it is. This creates conflict within society.

Within developing countries, the status quo used to be that the first step in structural transformation required that labor be moved out from the agricultural sector and into the manufacturing sector. In the past decade, with the advent of globalization, we have seen some phenomena that might lead to different conclusions.

Current developing countries, even those experiencing sustained economic and productivity growth, have been peaking in the share of employment in manufacturing sooner than their more developed peers did in the past[1]. This is to say, generally it is observed that as a country develops their shares of employment in Agriculture go down, and their shares in Services go up. Manufacturing however, increases for low levels of development and decreases for high levels of development. But in more recent times, various economists have observed that the period of industrial share of labor employment growth is becoming shorter and shorter. Even countries experiencing productivity growth overall and in manufacturing in particular have apparently done so without increasing their employment share in manufacturing; for example India[2]. This phenomenon of *jobless growth* in manufacturing would indicate that a country can not lean into manufacturing in a first phase of structural transformation because it will not absorb labor and, as we will soon see, we need to move labor into more productive endeavors. Lastly there has been some work that shows that productivity

[1] For more on this Rodrik (2015) and Dasgupta and Singh (2006)
[2] Dasgupta and Singh (2006)

gaps in manufacturing are larger than in the aggregate for most countries and thus moving labor from agriculture into manufacturing would actually have a negative impact on aggregate productivity, at least from a static logic point of view[3].

This, and more factors, led to a belief that *services-led development* was now the most prominent path for developing countries to follow. Instead of going leaning into manufacturing after agriculture and only then into services, moving labor directly into services from agriculture should be the first step of development.

Services led-development is in contraposition to what the classical development economists theorized in the 1960s, that was summarized in three growth laws by Nicholas Kaldor explaining why manufacturing was the necessary engine of growth[4]

Taking into account the previous introduction, the objective of this thesis is to in the first place present an updated view of the stylized facts of structural transformation and to answer whether manufacturing is still a necessary first step for development, that is, if manufacturing can still be considered an engine for modern economic growth.

Now we will present the sections of our work. This first part was the introduction. Next, on our second section we will present the theoretical frame we will use in our argument, this will first consist on the exposition on the ways to accurately measure the change in aggregate productivity when changing the sectoral composition and secondly on the way in which manufacturing is, according to classical development economists, a special sector of the economy. After that we will, in the third section, present the stylized facts of structural transformation with more contemporary data. The fourth section will present and contrast the arguments for each side of the discussion together with empirical examples that will allow us to conclude on the matter that manufacturing is indeed still a fundamental engine for growth. In the fifth section we will present our final conclusion.

[3] For more on this see Herrendorf, Rogerson and Valentinyi (2022)
[4] For more review on this topic see Andreoni and Gregory (2013)

Theoretical Framework

As we noted in the introduction, there can be no increase in per capita wealth if there is not an increase in per capita GDP which can not happen if there is not an increase in aggregate labor productivity. Per unit of labor, the aggregate productivity of the economy needs to sustainably increase if a country is to develop.

How is the aggregate productivity measured and composed?

If we define aggregate productivity of labor as Y then it would be the sum of the productivity of each sector y_i ponderated by the sector's share of the total labor in the economy. Then:

$$Y = \sum_i y_i * \theta_i$$

where *i* can be, according to the common distinction we use in this work, either manufacturing, services or agriculture.

Going one level deeper we can model the way that aggregate productivity varies with Labor.

$$\frac{dY}{dL} = \Delta Y = \sum_{i=n} \theta_{i,t-k} \Delta y_{i,t} + \sum_{i=n} y_{i,t} \Delta \theta_{i,t}$$

The equation above states that the change in aggregate productivity in an economy (ΔY) has two components, the first one is the productivity growth within sectors ($\sum_{i=n} \theta_{i,t-k} \Delta y_{i,t}$) and the second one is the productivity growth caused by structural change ($\sum_{i=n} y_{i,t} \Delta \theta_{i,t}$), that is the change in the employment share of each sector, which alters the aggregate productivity as well.

The *within* productivity growth is the sum of the change in a sector's productivity ponderated by that sector's share of labor. The *structural change* productivity growth is the sum of each sector in the economy labor productivity ponderated by the change in their share of employment.

This notes the importance of focusing first on which type of productivity one might be analyzing, otherwise conclusions might be drawn that are not precise enough. For example a country might open themselves to international trade in the hopes that they gain aggregate productivity; competition will come and less productive firms will be displaced, sectoral productivity (growth *within*) will increase for that sector. However, the share of employment in these sectors will fall, and this labor will have to be relocated. If they move to a less productive sector or to informality even, aggregate productivity might end up falling and although productivity increased in a specific sector, overall aggregate productivity decreased, making the country poorer in a sense.

The country will have experienced growth reducing structural change. This is more of a problem for developing countries, because as we saw before, they have a characteristic where intersectoral productivity gaps are more severe, and the sector to which labor gets displaced might

typically be one of the more informal ones. So not all structural change induces growth, this will be useful when comparing the evidence of the services sector with the manufacturing sector.

A clear example of this first representation of the change of aggregate productivity with respect to a variation in labor would be the following figure taken from McMillan et al (2011). The Figure below shows that the more productive a country is, the less intersectoral variation in productivity levels there is as well. This illustrates that developing countries have a low hanging fruit to grow, the *structural change* component, and developed countries can only grow by growing their *within* sectoral productivities and afterwards adjusting to them.

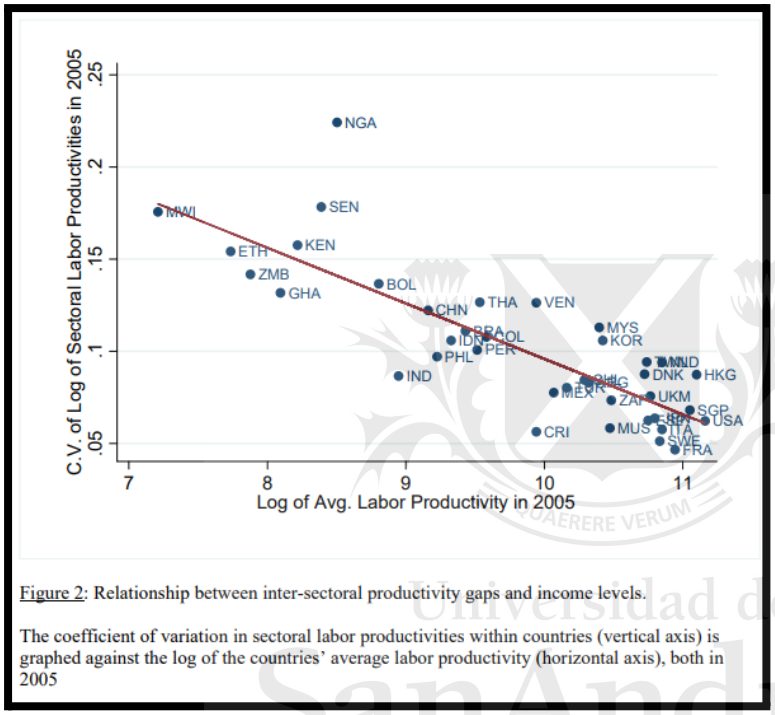


Figure 2: Relationship between inter-sectoral productivity gaps and income levels.

The coefficient of variation in sectoral labor productivities within countries (vertical axis) is graphed against the log of the countries' average labor productivity (horizontal axis), both in 2005

Figure 1: Relationship between inter-sectoral productivity gaps and income levels. Figure taken from McMillan et al (2011).

Still, another level of depth remains, we can decompose the *structural change* productivity growth component into two components more, this is when labor moves from one sector to another, there is a static variation of changing labor distribution among sectors and then there is the dynamic variation which comes from the marginal productivity of the sectors that altered their labor input. This can be represented as follows:

$$\Delta Y = \sum_i \theta_{i,t-k} \Delta y_{i,t} + \sum_i y_{i,t-k} \Delta \theta_{i,t} + \sum_i \Delta y_{i,t} \Delta \theta_{i,t}$$

In this new representation of the change in aggregate productivity the second component (*structural change* productivity variation component) changes, it is now divided into two new components;

one ($\sum_i y_{i,t-k}\Delta\theta_{i,t}$) shows the growth obtained from the initial productivity levels of the new sector to which labor is being reallocated, before the labor reallocation, while the other new component ($\sum_i \Delta y_{i,t}\Delta\theta_{i,t}$) shows the growth obtained from the variation of the sector's labor productivity level (from *t-k* to *t*) because of the reallocated labor. The component captures the labor productivity variation of the sector as its labor share changes, its marginal returns to labor increase to be more precise.

These two components are the *static* gains (or losses, if the sector's labor productivity in t-k is lower than the sector from which labor is coming from) and the *dynamic* losses (or gains if the marginal productivity to labor is still positive in the sector receiving labor) in sectoral productivity. This is key to understanding why it is not just a question of which sector has the highest productivity, it is also relevant the absorption capacity for labor of a sector when analyzing the optimal structural transformation path of an economy. This is very well represented by McMillan et al (2011) in the following figure which graphs the economic sectors in the Turkish economy with their respective labor force size and sectoral productivity levels.

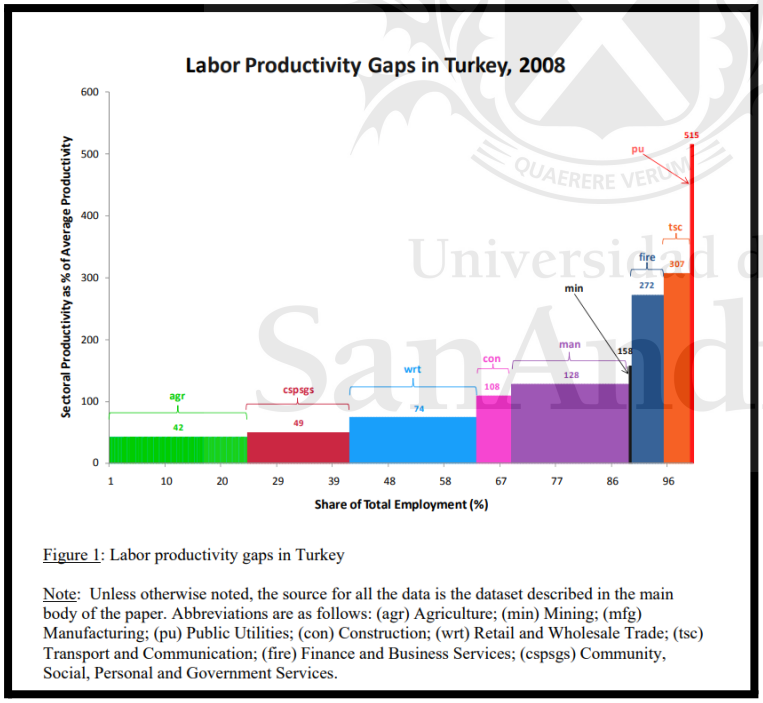


Figure 1: Labor productivity gaps in Turkey

Note: Unless otherwise noted, the source for all the data is the dataset described in the main body of the paper. Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 2: Labor Productivity Gaps in Turkey, 2008. Figure taken from McMillan (2011).
Interpretation: The share of Total Employment is represented in the x axis against the sectoral productivity.

If we were not aware of the concept of static and dynamic productivity gains we would be quickly to suggest that we move all employment to (pu) Public utilities and we would find that as we increase the labor dedicated to public utilities its productivity levels would decrease drastically to a point where the aggregate productivity of the economy descends altogether.

Those are the levels of abstraction that we will use to analyze the change in aggregate productivity in some studies by other economists.

Furthermore, we will see the special features by which the manufacturing sector is "special" in terms of capacity for developing an economy. This special characteristics were consolidated in three laws by Nicholas Kaldor:

1. The faster the rate of manufacturing sector growth, the faster the rate of growth of the whole economic system
2. There is a positive causal relationship between the growth of the manufacturing sector and manufacturing productivity growth; this is because the increase in market size allows for further specialization that then further increases productivity
3. Aggregate productivity growth is positively related with growth in employment in manufacturing, while negatively related with growth in employment in other non-manufacturing sectors

The second law would be the manufacturing sector's inner special feature, which through the first and third law spreads to the whole system. If growth in the manufacturing sector increases further specialization within the labor in manufacturing and in return increased productivity; then first through a) the manufacturing sector growth would propel the whole economic system's growth and through b) the growth in employment demand for the expanding sector would then increase aggregate productivity.

As explained by Andreoni and Gregory (2013) the special properties implicit in the synergy between manufacturing output and productivity growth are the following: it allows for more capital accumulation and intensification, it allows for greater economies of scale and allows for greater learning through which technical progress can be generated. The greater learning property is not only about incremental productivity gains but also about how the development process leads to an entirely new industry. As is the case for example of software stemming from hardware; as the hardware machinery industry expands, the software to run it becomes more complex and because of the industries larger size specialization is possible. This specialization in turn breeds an entirely new industry, the software industry.

We now have the representations of aggregate productivity and how it changes with structural change, or labor rearrangement. We have as well the theory that sustains that manufacturing is special in ways that exceed simply the direct productivity gains.

In the following section we will see the stylized facts of structural change with respect to the three sectors; agriculture, manufacturing and services.

Stylized Facts of Structural Change

Structural change refers to the reallocation of economic activity across agriculture, manufacturing and services. This is the process that we referred to before that accompanies modern economic growth. The problem with measuring is to choose the correct variable.

There are three common measures of structural transformation. Firstly, employment shares of each sector, which can be measured with the number of workers but a more precise measure of the labor input would be hours dedicated. Secondly, value added shares and thirdly final consumption shares.

Each one of these can vary a lot. First the first two variables are related to production measures whereas the last one is related to consumption. Then, value added and final consumption are entirely different concepts, even if they refer to a product in the end, they measure entirely different things.

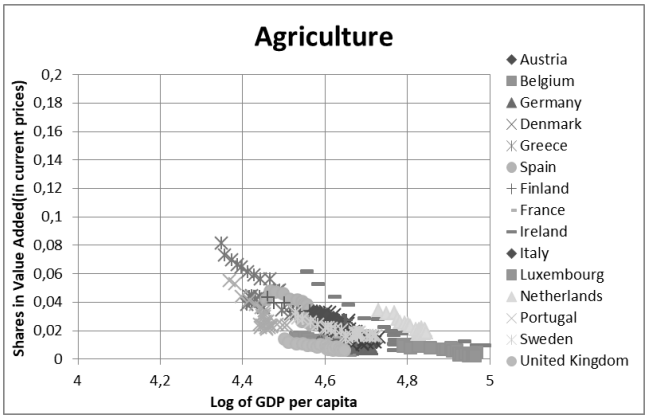
Let's take manufactured goods as an example. If we measure it as final consumption, the whole of it will correspond to the manufacturing sector whereas if we only look at value added we will give a piece of value added to say the agricultural sector for the cotton, another piece to the manufacturing for the processing and lastly another to the service sector for distribution when the shirt was sold.

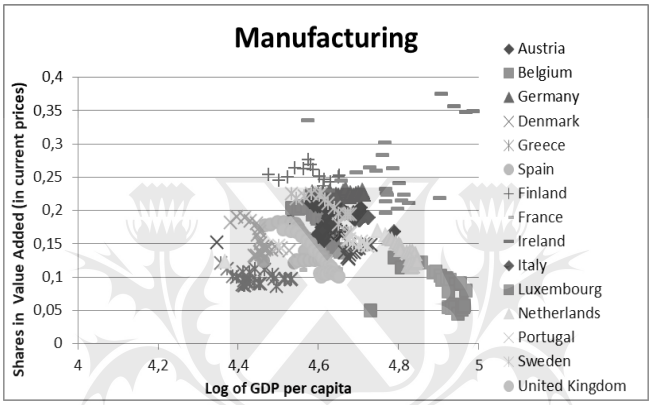
Luckily, Herrendorf, Rogerson and Valentinyi (2013) took this into account when reviewing the stylized facts of structural change with more contemporary data. Below we see the sectoral Shares of employment and Value Added for Selected Developed Countries from 1995 up to 2019. We used the base from Herrendorf, Rogerson and Valentini (2013) and updated it by adding data up to 2019. We chose PWT 10.01 where it has each GDP for the countries and made it per capita, obtaining a Log of GDP per capita.

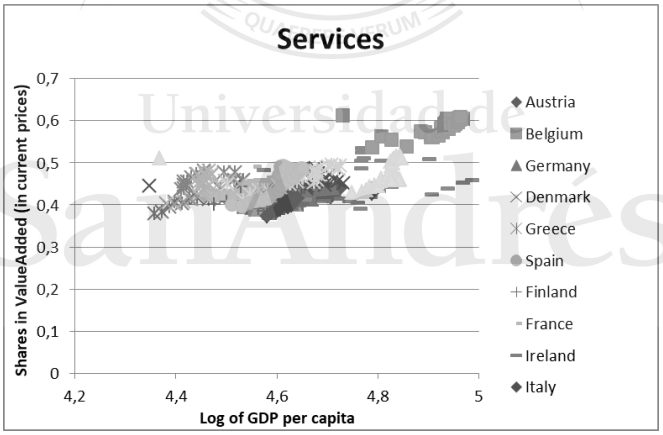
In relation to the Shares in Value Added and Shares in hours worked, we took the data from EU KLEMS which explains the national accounts for each of the developed European countries we chose to show. For the Value Added, we extracted the information for Gross Value Added in current prices for each sector and divided it by the total from the economy to show the shares. The same was made with the employment data, but in this case the information extracted was from the total hours worked by employees.

For all 6 charts, in the X axis we have the logarithm of the gross domestic product per capita. For the first three charts, on the Y axis we have the share in value added. For the three others, on the Y axis we have the sectoral share in employment, measured in total hours worked by the employees.

Value Added

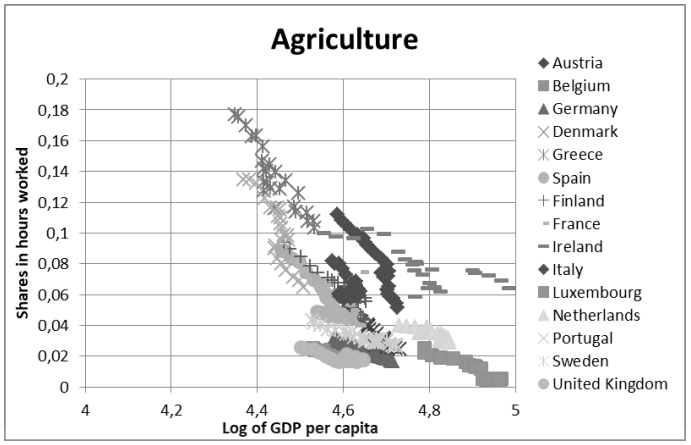


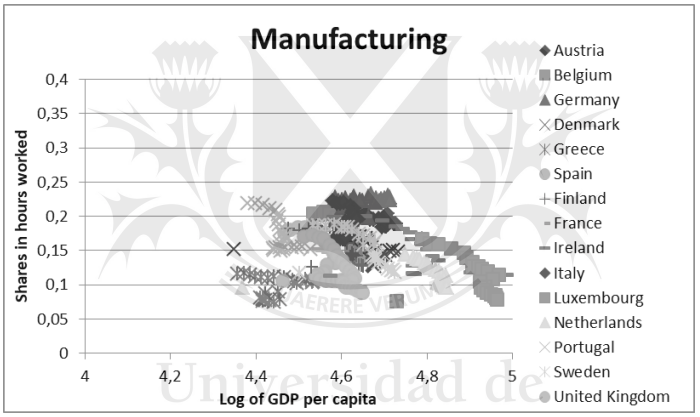


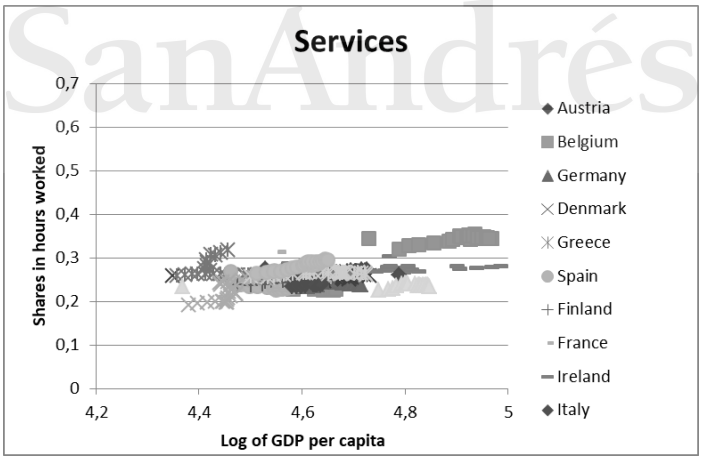


Sectoral Shares of Employment and Value Added for selected developed countries for the period 1995-2019.
SOURCE: EU KLEMS, PWT 10.01. Interpretation: Each point is a country in a year for the period 1995-2019 for which the logarithm of GDP per capita is graphed against the shares of value added for each sector.

Hours worked







Sectoral Shares of Employment and Value Added for selected developed countries for the period 1995-2019.
SOURCE: EU KLEMS, PWT 10.01. Interpretation: Each point is a country in a year for the period 1995-2019 for which the logarithm of GDP per capita is graphed against the shares of total hours worked for each sector.

We see that increases in GDP per capita are associated with decreases in both employment and nominal value added share in agriculture but increases in the same measures for services.

For manufacturing we see that for low levels of development and for higher levels of development an increase in gdp is related with a decrease in the share of manufacturing employment and value added share.

As Herrendorf, Rogerson and Valentinyi (2013) make use of the World Development Indicators database and the National Accounts database collected by the United Nations Statistics Division to understand if these stylized facts we are witnessing in developed countries, stand for developing countries as well, we try to replicate the information but using the different regions we have in the world, to see if these only happens in European countries or is a phenomenon that is shown for the sectors no matter the group the country is in.

Figure 2 documents the shares of nominal value added as functions of the level of development for 22 African countries, 9 LATAM countries and 19 from Asia. The vertical axis is the share of value added in nominal prices in one of the three broad sectors. The horizontal axis is as before the logarithm of the GDP per capita in 2017 international dollars.

On the next page we can see Value added share vs log of GDP per capita for these countries databases for agriculture, manufacturing and services plotted below.

Value Added Shares vs Logarithm of GDP per Capita, by Sector and by Region for the period 1990-2018

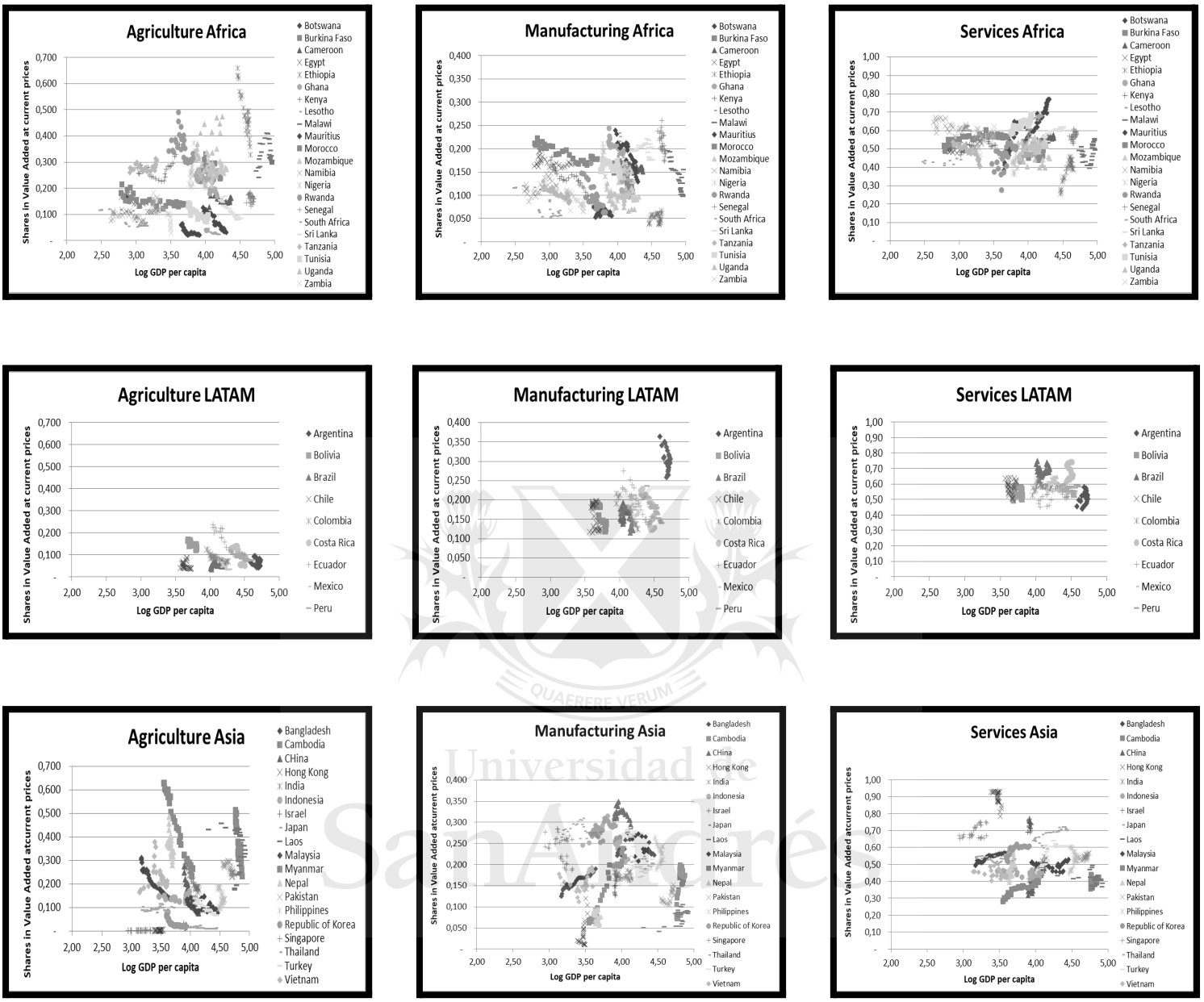


Figure 2: Sectoral Shares in Value Added for each region for Africa, Latin America & Asia for the period 1990-2018. **SOURCE: GGDC Economic Transformation, PWT 10.01.** Interpretation: Each Graph represents a Sector (Agriculture, Manufacturing or Services) and a region (Africa, Latin America and Asia) for which a sample of its countries are plotted regarding its logarithm of gdp per capita and the share of value added of the corresponding sector.

Some patterns and differences are noticeable. First Asia's structural transformation stylized facts are very clear. Agriculture's share in value added has steadily decreased as countries have developed. Services have a general upward trend, although not as steep as the agriculture sector. Manufacturing has been steadily increasing as well, there is no immediate general sign of deindustrialization.

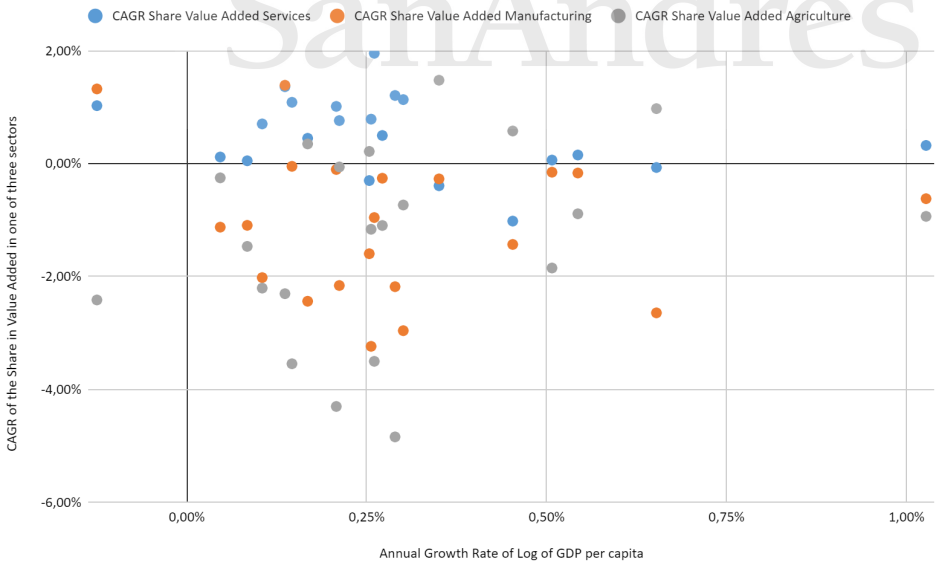
These observations strongly contrast with the trends present in Latin America and Africa. Agriculture's value added seems to have decreased with the increase in development in most African

countries but still seems to have increased in some. Latin America seems to have experienced less change across development levels in agriculture's share of value added but the trend seems slightly downwards. The services sector has increased its share of value added across all countries in the sample as the logarithm of the GDP per capita has increased, it is a clear result. But when it comes to manufacturing the contrast is the largest with respect to Asia, manufacturing's share of value added in both regions across all countries in the sample has steadily decreased whereas in Asia it steadily increased.

The more an economy increases its level of development, the less share of labor it dedicates to agriculture and the more it dedicates to services. Whereas in the case of manufacturing, the relationship is not so monotonous, in general terms, the share of labor dedicated to manufacturing increases at low levels of development and decreases at higher levels of development. The same is true for shares of value added for each sector. The noticeable caveat appears to be that within developing regions some have begun deindustrialization way earlier than their developed counterparts. Whereas developed countries seemed to peak around 4,6 value for logarithm of GDP per capita, for Africa all countries except one find themselves between 2.5 and 4.5 values of logarithm of GDP and still, all have decreased their shares of value added. In a similar fashion, Latin America's countries have mostly steadily decreased their share of value added share of manufacturing despite having their logarithms of gdp between 3.5 and 4.5 in most cases. The only exception between the examined regions is Asia, which seems to not have reached its maximum share of manufacturing value-added yet and is showing no signs of entering a de-industrialization.

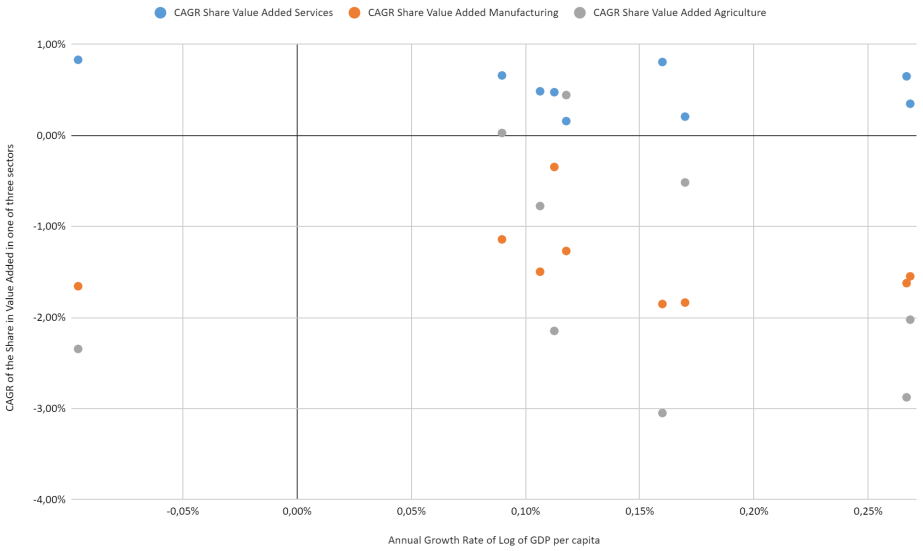
We can see this information and contrast between regions in another manner to better visualize.

Compound Annual Growth Rate (CAGR) of Logarithm of GDP vs CAGR of value added in the three sectors (Agriculture, Manufacturing and Services) for Africa



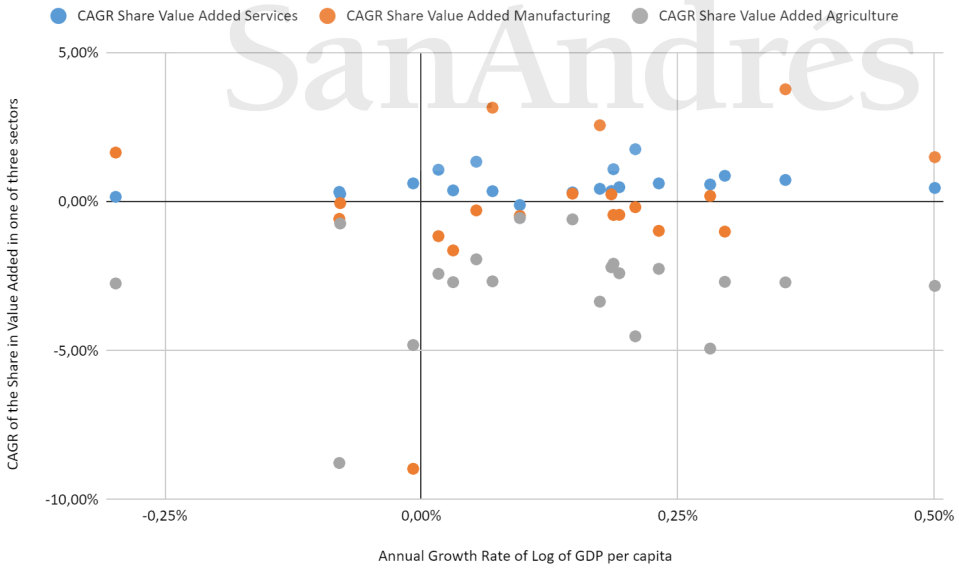
SOURCE: GGDC Economic Transformation, PWT 10.01. Interpretation: Each point represents a country in Africa and its Compound Annual Growth Rate of the Log of GDP for the period 1990-2018 and the Compound Annual Growth Rate of the Share of Value Added for a Sector for the period 1990-2018, The sector can either be Services, Manufacturing or Agriculture.

Compound Annual Growth Rate (CAGR) of Logarithm of GDP vs CAGR of value added in the three sectors (Agriculture, Manufacturing and Services) for Latin America



SOURCE: GGDC Economic Transformation, PWT 10.01. Interpretation: Each point represents a country in Latin America and its Compound Annual Growth Rate of the Log of GDP for the period 1990-2018 and the Compound Annual Growth Rate of the Share of Value Added for a Sector for the period 1990-2018, The sector can either be Services, Manufacturing or Agriculture.

Compound Annual Growth Rate (CAGR) of Logarithm of GDP vs CAGR of value added in the three sectors (Agriculture, Manufacturing and Services) for Asia



SOURCE: GGDC Economic Transformation, PWT 10.01. Interpretation: Each point represents a country in Asia and its Compound Annual Growth Rate of the Log of GDP for the period 1990-2018 and the Compound Annual Growth Rate of the Share of Value Added for a Sector for the period 1990-2018, The sector can either be Services, Manufacturing or Agriculture.

In each graph a point represents a country in the region and its CAGR in one sector and its CAGR of the logarithm of its gdp per capita. In all three regions the Agriculture Sector Value Added Share has shrunk and the higher the growth rate of the logarithm of the gdp per capita the more the agriculture sector's share of value added seems to have shrunk. What is more, the pattern for the services sector seems to be inverse: all countries within all three regions seem to have expanded the value added share of the services sector and the higher the growth rate of the logarithm of the gdp per capita of the economy the bigger the expansion is, except for Africa where that correlation does not seem to be clear. Regarding the Manufacturing sector, the contrast between Asia on one side and Africa and Latin America on the other appears once again. In Africa and Latin America the manufacturing sector has reduced its share of value added in manufacturing in all but two economies. In Latin America the higher the CAGR of the period the more the manufacturing sector seems to have shrunks its share of value added. In Africa, the pattern is less conclusive. Nevertheless, the point stands, both Africa and Latin America have significantly shrunk their share of manufacturing value added over the 1990-2018 period. Asia, on the other hand, has a significant portion of the countries, 8 out of the 20 in the sample, that have enlarged the value added share of the manufacturing sector. What is more, the more the country has grown its GDP per capita over the years, the more the manufacturing sector's share of value added has increased in the period. This corresponds with the patterns observed before.

Could it be a coincidence that Asia is the only one of the three regions regarded as a case of successful modern economic growth?

Services or Manufacturing: Evidence on Structural Change & on Manufacturing's Special Properties

As we already mentioned in the introduction to this work, certain patterns have become noticeable in the current leading developing countries that have caused economists to doubt whether manufacturing is the sector to which labor should be moved from agriculture; as opposed to services for example. This phenomena includes, but is not limited to: suspected premature deindustrialization and jobless growth of the manufacturing sector of the leading developing countries.

In this section we will first see if manufacturing is still a better option than services for developing countries to move labor from agriculture to, as opposed to services. After that we will see if Kaldor's laws still hold for developing countries by reviewing a paper by Dasgupta and Singh.

On the first objective of this section, the authors Herrendorf, Rogerson and Valentinyi (2022) test the premise that manufacturing is indeed the first best option for developing countries to grow. In their view, if successful development of developing economies requires that the first step of structural transformation be that labor moves from agriculture into manufacturing, one of these two points should be true.

1. The manufacturing sector has a higher aggregate productivity than other non agriculture sectors

2. In time, manufacturing sectoral productivity tends to converge to the frontier level manufacturing productivity that exists in the world economy

To test the first premise the authors plot for three distinct years (1990,2005 and 2018) for each sector (Agriculture, Services and Manufacturing) the sector's productivity relative to its frontier against the aggregate productivity relative to the aggregate productivity frontier. If manufacturing is to be favored when moving labor out of agriculture then we should expect for its gap with the frontier to be smaller than the aggregate, the authors argue, and certainly smaller than in agriculture.

Figure 5: Agricultural vs. Aggregate Productivity Relative to Respective Frontier
(64 countries in EETD, 2005)

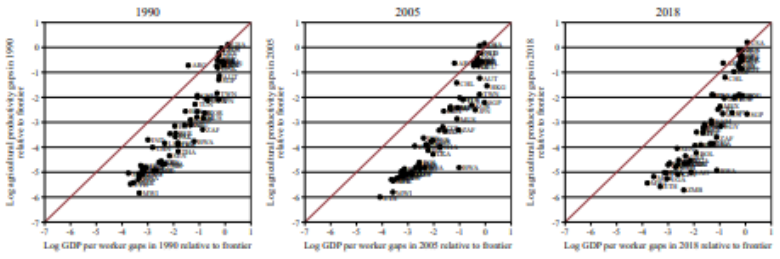


Figure 3: Agricultural vs. Aggregate Productivity Relative to Respective Frontier. Figure taken from Herrendorf, Rogerson and Valentinyi (2022).

In Agriculture, the productivity gaps relative to the frontier are larger than in the aggregate. See Figure 3 above, where the Log of GDP per worker relative to the frontier is graphed against the Log of agricultural productivity per worker relative to the frontier for the years 1990, 2005 and 2018 for the

64 countries covered by the database used by the authors. The only clear exception is Argentina, which has an agricultural productivity higher than expected due to its natural gifts.

Manufacturing, on the other hand, has become less attractive in terms of sectoral productivity. See figure 4 below. In 1990 where the results were very ambiguous, the manufacturing productivity was in some countries above the aggregate and in others below. But by 2005 it was clear that it was below the aggregate which is not very encouraging for people in agreement today with Kaldor's laws.

Figure 6: Manufacturing vs. Aggregate Productivity Rel. to Respective Frontier
(64 countries in EETD)

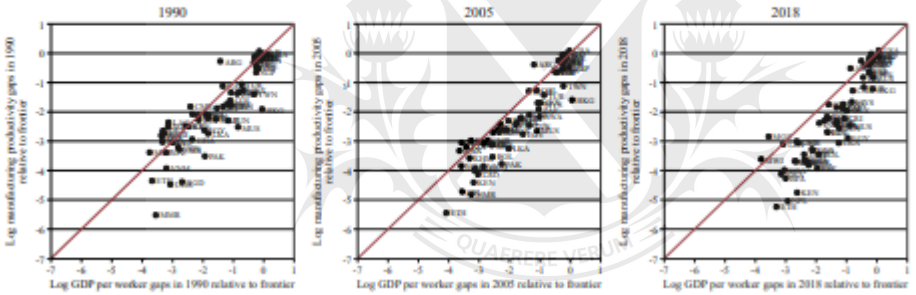


Figure 4: Manufacturing vs. Aggregate Productivity Relative to Respective Frontier. Figure taken from Herrendorf, Rogerson and Valentinyi (2022).

Lastly the authors check if at least the services sector is above the aggregate in terms of productivity. While the gaps in goods are, like in agriculture and manufacturing, larger than in the aggregate, in Market and Non-Market Services they are smaller. See Figure 5 below, also taken from Herrendorf, Rogerson and Valentinyi (2022).

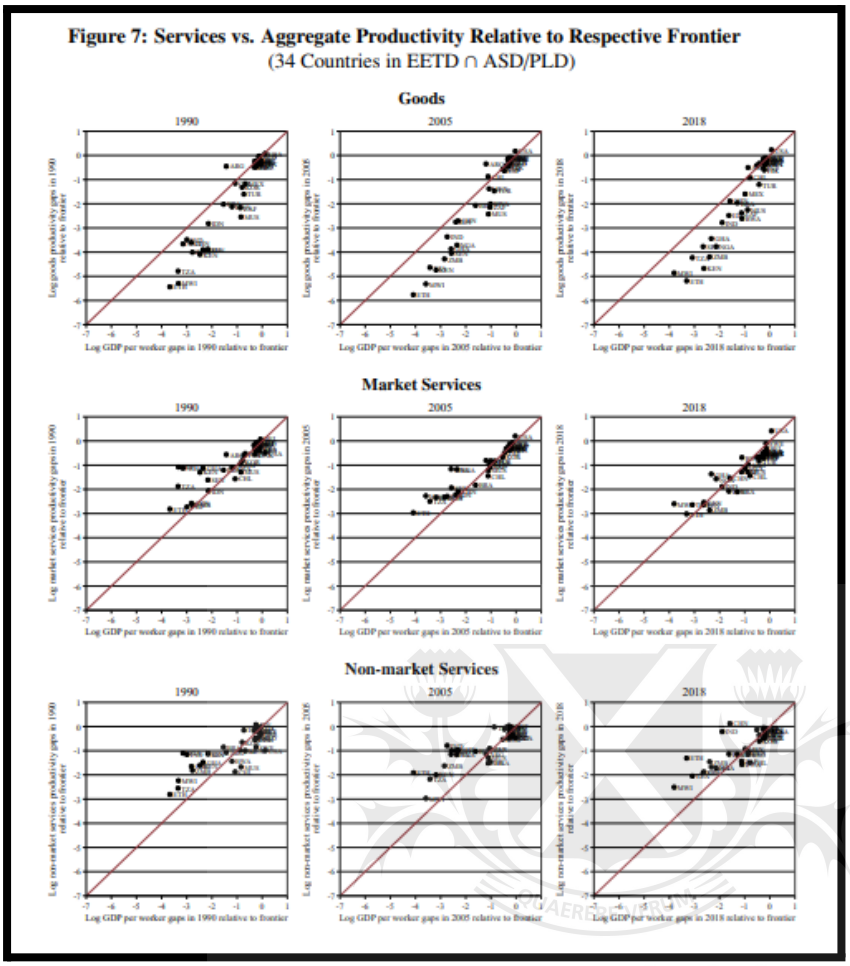


Figure 5: Services vs. Aggregate Productivity Relative to Respective Frontier. Figure taken from Herrendorf, Rogerson and Valentinyi (2022).

This is to say that if we were to fall into a simple static gain / loss in productivity logic explained in the theoretical framework section, we would not be wise to recommend manufacturing over services to developing countries.

However, authors like McMillan (2011) have found that is not the case. By looking at the different experiences that countries in different regions had with the structural change brought about by their increased openness to international trade and finance, she found that regions experienced different types of structural change depending on their initial conditions and the external policy initiatives taken by the government. These different experiences after trade liberalization involved regions like Asia moving labor from agriculture towards manufacturing while achieving high rates of productivity growth and regions like Africa and Latin America moving labor from agriculture towards services mainly and experiencing negative to slow productivity growth.

From the 1950s up until 1990 its annual productivity growth rate was almost 4%. Of those 4% almost half was brought by structural change, the other half was growth within each sector, from the implementation of productivity enhancing improvements. This fact is illustrated by McMillan (2011) in Figure 6 below.

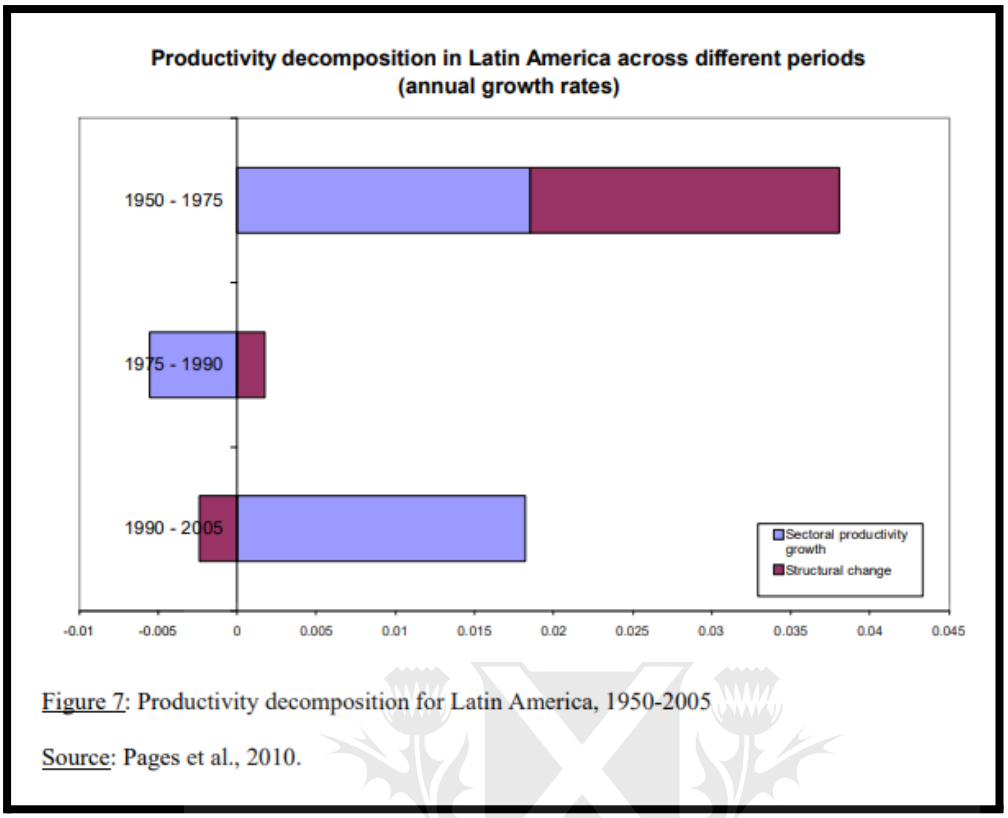


Figure 6: Productivity decomposition in Latin America across different periods (annual growth rates). Figure taken from McMillan (2011).

After the 1975 debt crisis hit the region, productivity growth was negative. When growth returned in 1990 the *within* component of growth was almost the same as in the previous period of growth, almost 1.8%. But the *structural change* component was negative, -0.2% approximately. What happened in the 90s?

McMillan illustrates the common knowledge about Latin America and the 1990s quite well:

"*Argentina, Brazil, Mexico, Chile, Colombia, and most of the other economies got rid of high inflation, brought fiscal deficits under control, turned over monetary policy to independent central banks, eliminated financial repression, opened up their economies to international trade and capital flows, privatized state enterprises, reduced red tape and most subsidies, and gave markets freer rein in general. Those countries which had become dictatorships during the 1970s experienced democratic transitions, while others significantly improved governance as well. Compared to the macroeconomic populism and protectionism, 15 import-substitution policies that had prevailed until the end of the 1970s, this new economic environment was expected to yield significantly enhanced productivity performance.*"

This indeed happened. And as we saw in the previous figure productivity within sectors did increase. The problem is the means by which it increased. As McMillan (2011) says, many studies have talked about the positive effects trade liberalization had on forcing industries to become more productive (citar e Pavcnik 2000, Paus et al. 2003, Cavalcanti Ferreira and Rossi 2003, Fernandes 2007, and Esclava et al. 2009). If a company was not as productive as their new competitors, they would shut

down and the sector would end up becoming more productive. The problem, as discussed before, is that the aggregate productivity of the country depends as well on what the displaced labor dedicate itself to after this process.

If the productivity gap were not as big as it is in developing countries, this process would effectively be positive, because labor that exits the industry allocates to other sectors with the same productivity levels, but the one that remains effectively is forced to become more productive to compete thus aggregate productivity grows.

Lets see the experience for different regions in this period. Below we have Figure 7 which shows us for the period starting in 1990 and ending in 2005, for 4 sets of countries their productivity growth in the period decomposed into growth within and growth due to structural change. The 4 groups are: countries in Latin America, which we already saw in detail above, countries in Africa, countries in Asia and High Income countries.

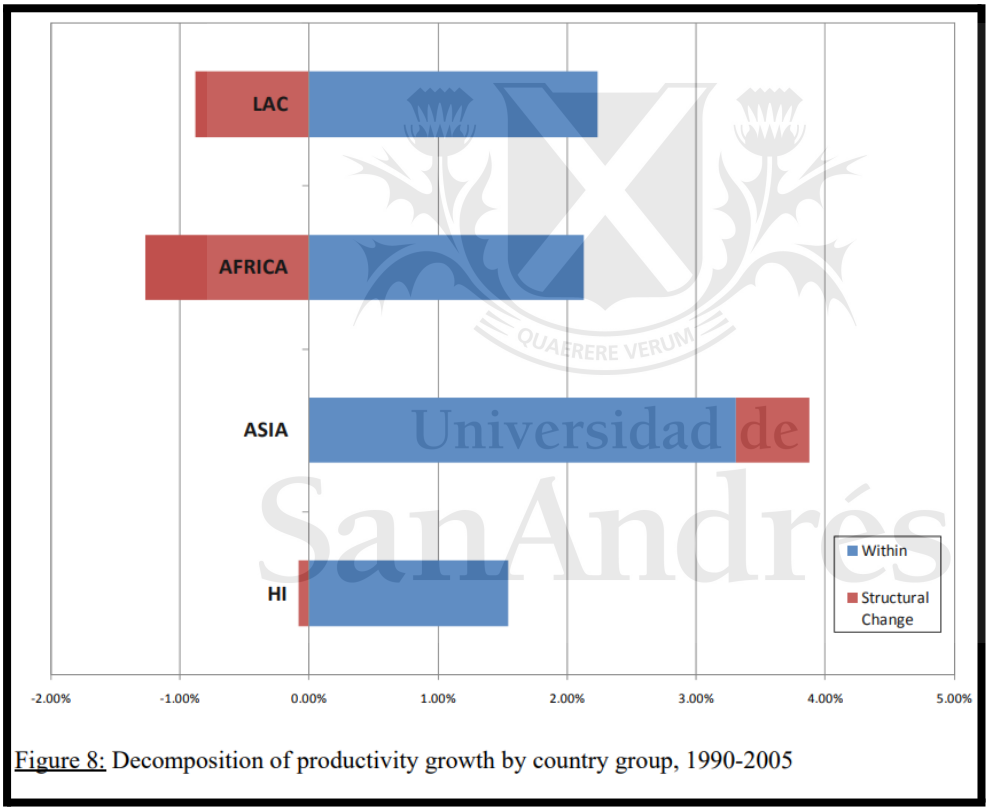


Figure 8: Decomposition of productivity growth by country group, 1990-2005

Figure 7: Decomposition of productivity growth by country group, 1990-2005. Figure taken from McMillan (2011).

The contrast is noticeable, while developing countries are all subject to significant impact in structural changes, only in Asia has that change been positive, whereas in Latin America and in Africa the change was negative. If all three regions have become more globalized the difference must be explained by region specific forces. Only Asia has, as Kuznets (1973) said was the challenge for developing countries looking to grow, managed to "*convert the new large potential of modern technology into economic growth"*.

We will now see two countries per region in detail in figures from McMillan, where for the period from 1990 up to 2005 each sector in the economy is plotted in an x axis that shows the change in its

employment share for the period and in the y axis the logarithm of the sector's productivity relative to the aggregate productivity of the country's economy. If we see specifically countries per region we will clearly see that in the case of the Asian countries they all increased the share of labor dedicated to manufacturing, being relatively a high productivity sector in the economy. Whereas the two African and Latin American examples decreased the size of their manufacturing sector. The services sector was increased in all of the 6 countries in general so that can not be the differentiating factor.

In Figures 8, 9, 10, 11, 13 and 14, all taken from McMillan (2011), we see the correlation between sectoral relative productivity and change in employment for the period from 1990 up to 2005. In Figure 9 and 10 we see Argentina and Brazil respectively while in Figure 11 and 12 we see Nigeria and Zambia. Both share the same clear negative correlation. The lower the productivity gain of the sector (*within* growth), the higher the employment share gain of the sector.Not only that but as we mentioned before, the sectors that gained employment are almost in their entirety services sectors. Effectively, introducing market friendly policies in these countries seems to have caused industry rationalization that caused labor to reallocate itself to less productive endeavors, which seem to be services. Whereas in Figure 13 and 14, we see the case of Thailand and India. The correlation is inverted in respect to the African and Latin American countries. The integration into the world economy has brought upon an expansion of the more productive sectors and a contraction of the less productive sectors, these countries seem to be the only ones among the six reviewed in which manufacturing expanded.

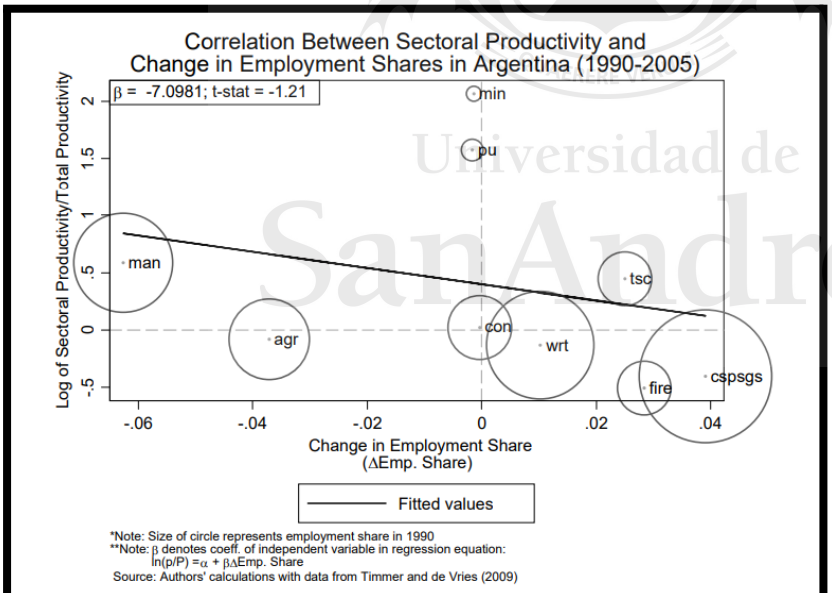


Figure 10

Note: Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 8: Correlation between sectoral productivity and change in employment shares in Argentina (1990-2005). Figure taken from McMillan (2011).

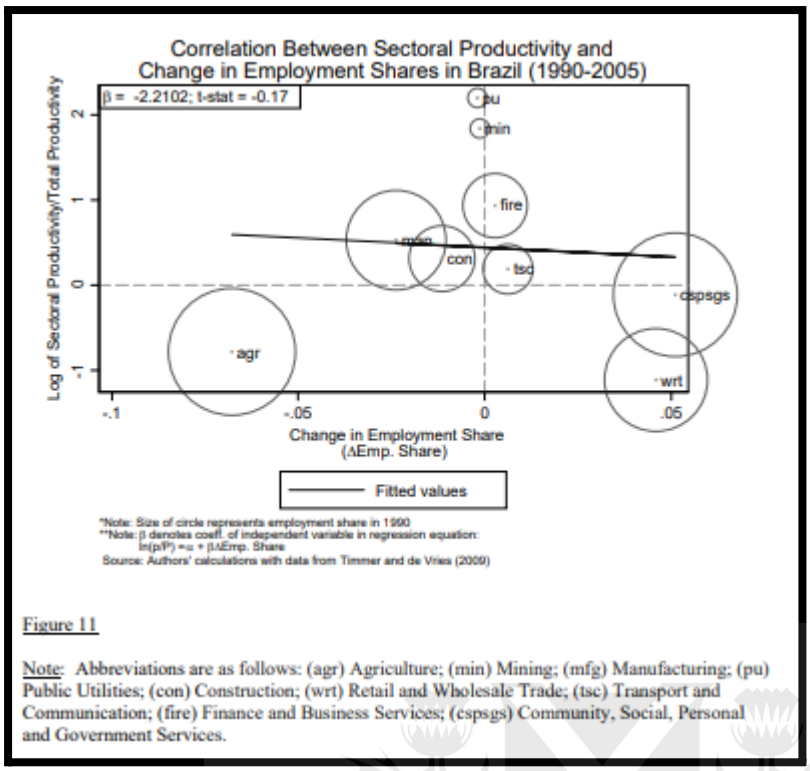


Figure 11

Note: Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 9: Correlation between sectoral productivity and change in employment shares in Brazil (1990-2005)

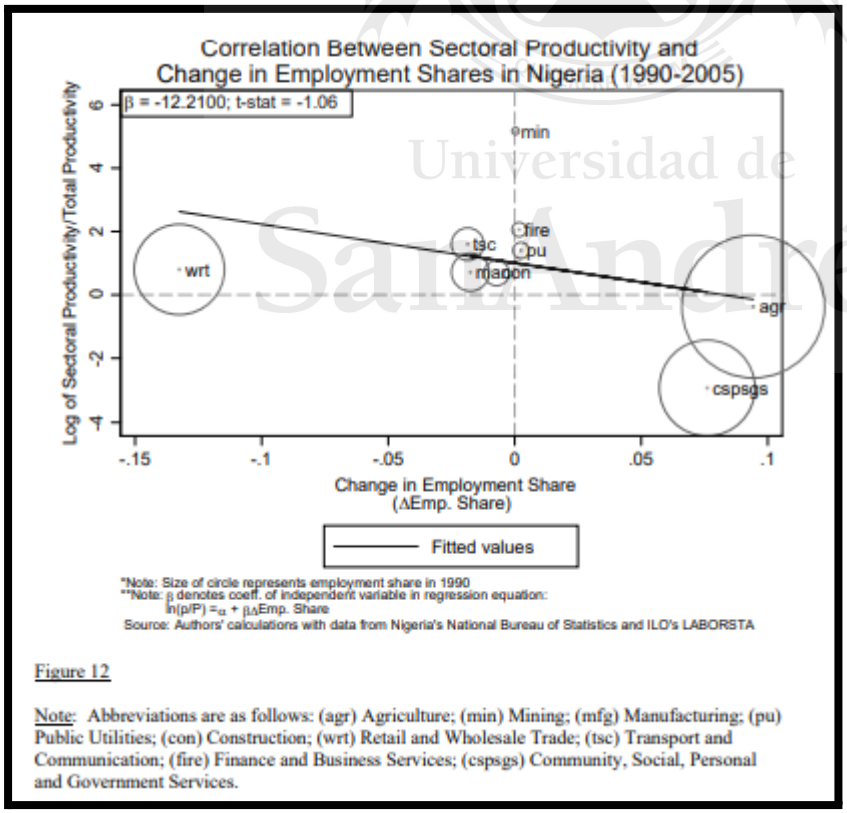


Figure 12

Note: Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 10: Correlation between sectoral productivity and change in employment shares in Nigeria (1990-2005)

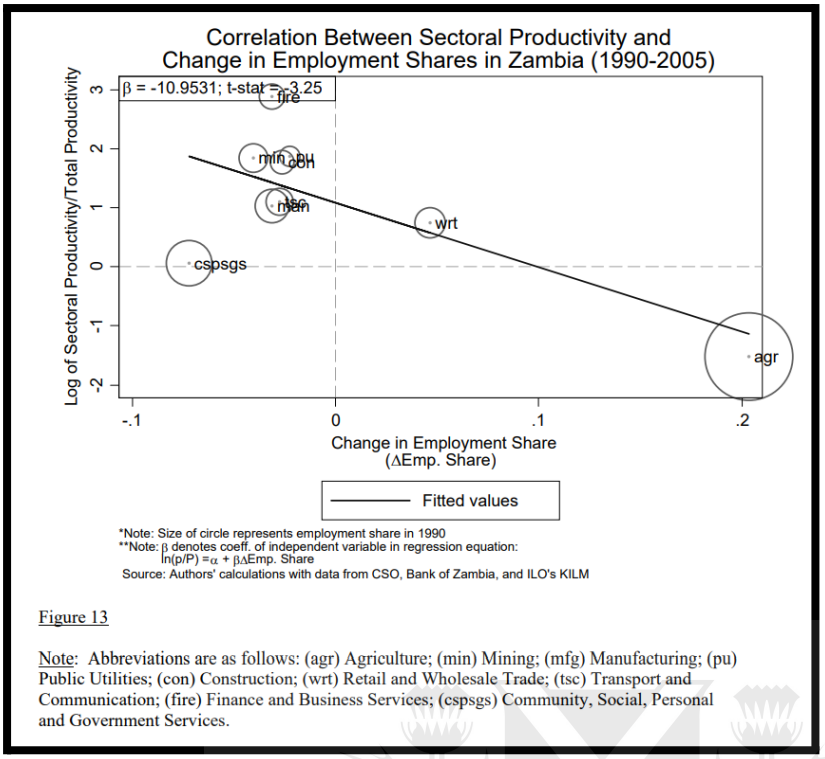


Figure 13

Note: Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 11: Correlation between sectoral productivity and change in employment shares in Zambia (1990-2005). Figure taken from McMillan (2011).

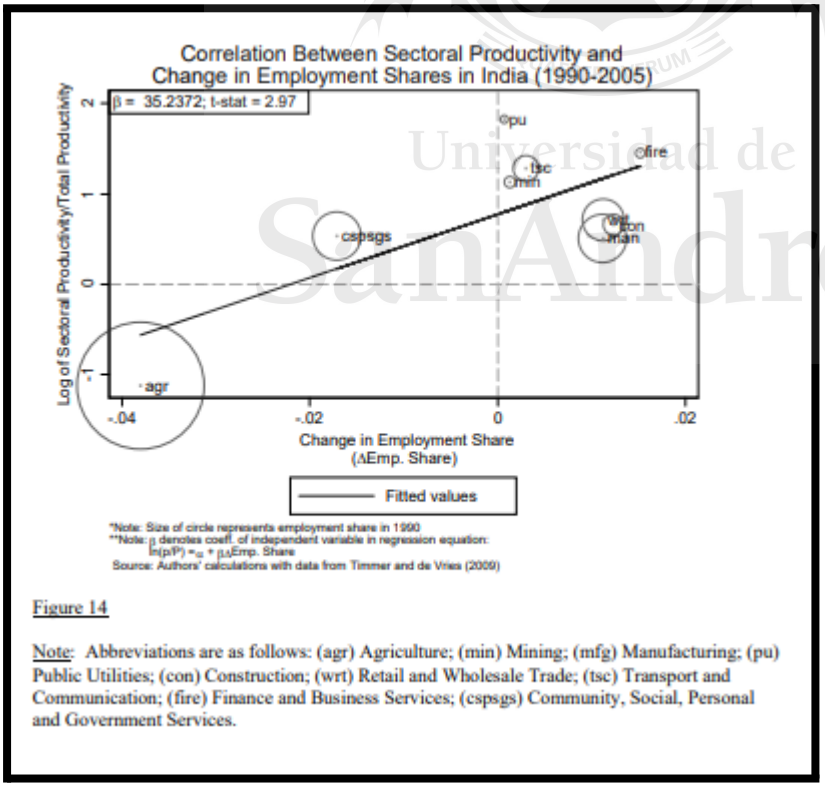


Figure 14

Note: Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 12: Correlation between sectoral productivity and change in employment shares in India (1990-2005). Figure taken from McMillan (2011)

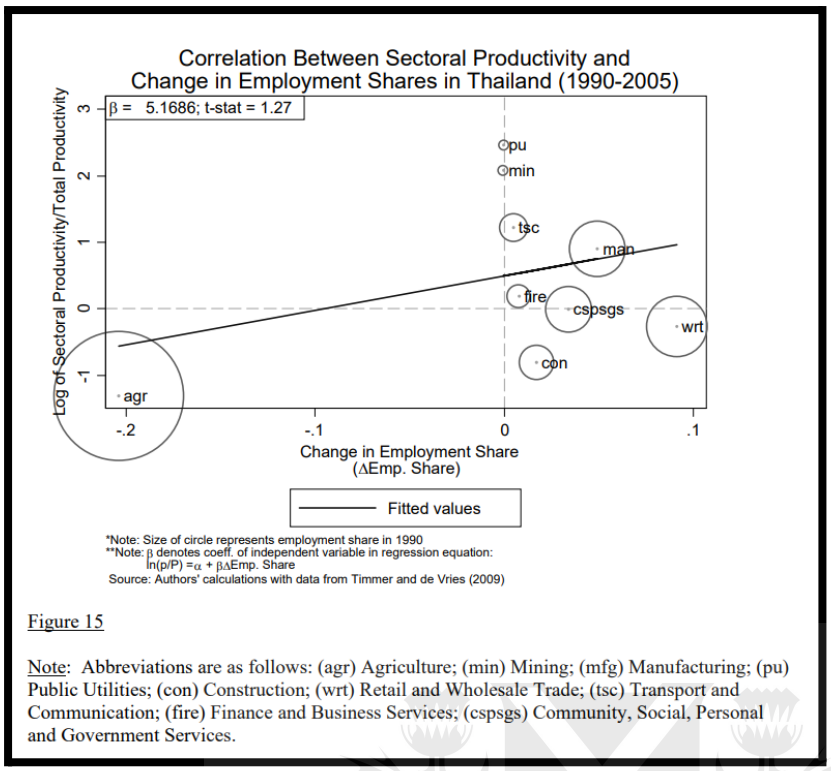


Figure 15

Note: Abbreviations are as follows: (agr) Agriculture; (min) Mining; (mfg) Manufacturing; (pu) Public Utilities; (con) Construction; (wrt) Retail and Wholesale Trade; (tsc) Transport and Communication; (fire) Finance and Business Services; (cspsgs) Community, Social, Personal and Government Services.

Figure 13: Correlation between sectoral productivity and change in employment shares in Thailand (1990-2005). Figure taken from McMillan (2011).

Then how do we reconcile both of these results? That is how do we reconcile the fact that the gaps in services are smaller than in the aggregate but it seems from evidence brought forward by McMillan that the difference between the development success in Asia and the failure in Africa and Latin America is that the latter regions contracted manufacturing while the former region expanded it.

De Vries (2015) studied in further detail the productivity gains and losses experienced in those same periods. It turns out that Africa and Latin America experienced slow *structural change* productivity growth or even degrowth because where they moved their labor, either intentionally or by the forces exposed to by trade liberalization, generated a negative *dynamic* component even though it had a positive *static* component.

Let's see the case of Africa in particular. From 1960 to 1975, Africa increased its employment share of manufacturing substantially, from 4.6 percent of the workforce to 7.8 percent of the workforce while agricultural labor share decreased. Simultaneously, the value added share of manufacturing increased as well, from 9.2 to 14.7 of the total value added. This was all in the context of heavy government intervention with an import substitution focus, that while some argue that it is a great cost to bear, as we saw before it might be a necessary initial restriction for developing countries interested in achieving growth inducing structural transformation. From 1975 up to 1990, there was an intense stagnation period. Employment in manufacturing barely rose, currency instability was rampant and agricultural employment continued to fall.

Just like we saw in McMillan's paper that Latin America returned to growth after a "Lost decade" in 1990, the African region too returned to growth and structural change resumed. But it was unlike the previously experienced growth. Agricultural share of employment declined from 61% in 1990 to 49% in 2010 but manufacturing employment did not expand, it actually fell from 8.9% to 8.3%, the sector

that benefited most was services. The employment share of services almost doubled to 20.1%. See Table 1 below obtained from De Vries (2015)

Table 1. Summary Statistics

	Country	Code	Economy-wide Labor Productivity*	Coef. of Variation of log of Sectoral Productivity	Sector with Highest Labor Productivity		Sector with Lowest Labor Productivity		Compound Annual Growth Rate of Econ.-wide Productivity
					Sector	Labor Productivity*	Sector	Labor Productivity*	(1990-2005)
High Income									
1	United States	USA	70,235	0.062	pu	391,875	con	39,081	1.80%
2	France	FRA	56,563	0.047	pu	190,785	cspsgs	37,148	1.20%
3	Netherlands	NLD	51,516	0.094	min	930,958	cspsgs	33,190	1.04%
4	Italy	ITA	51,457	0.058	pu	212,286	cspsgs	36,359	0.73%
5	Sweden	SWE	50,678	0.051	pu	171,437	cspsgs	24,873	2.79%
6	Japan	JPN	48,954	0.064	pu	173,304	agr	13,758	1.41%
7	United Kingdom	UKM	47,349	0.076	min	287,454	wrt	30,268	1.96%
8	Spain	ESP	46,525	0.062	pu	288,160	con	33,872	0.64%
9	Denmark	DNK	45,423	0.088	min	622,759	cspsgs	31,512	1.53%
Asia									
10	Hong Kong	HKG	66,020	0.087	pu	407,628	agr	14,861	3.27%
11	Singapore	SGP	62,967	0.068	pu	192,755	agr	18,324	3.71%
12	Taiwan	TWN	46,129	0.094	pu	283,639	agr	12,440	3.99%
13	South Korea	KOR	33,552	0.106	pu	345,055	fire	9,301	3.90%
14	Malaysia	MYS	32,712	0.113	min	469,892	con	9,581	4.08%
15	Thailand	THA	13,842	0.127	pu	161,943	agr	3,754	3.05%
16	Indonesia	IDN	11,222	0.106	min	85,836	agr	4,307	2.78%
17	Philippines	PHL	10,146	0.097	pu	90,225	agr	5,498	0.95%
18	China	CHN	9,518	0.122	fire	105,832	agr	2,594	8.78%
19	India	IND	7,700	0.087	pu	47,572	agr	2,510	4.23%
Middle East									
20	Turkey	TUR	25,957	0.080	pu	148,179	agr	11,629	3.16%
Latin America									
21	Argentina	ARG	30,340	0.083	min	239,645	fire	18,290	2.35%
22	Chile	CHL	29,435	0.084	min	194,745	wrt	17,357	2.93%
23	Mexico	MEX	23,594	0.078	pu	88,706	agr	9,002	1.07%
24	Venezuela	VEN	20,799	0.126	min	297,975	pu	7,392	-0.35%
25	Costa Rica	CRI	20,765	0.056	tsc	55,744	min	10,575	1.25%
26	Colombia	COL	14,488	0.108	pu	271,582	wrt	7,000	0.18%
27	Peru	PER	13,568	0.101	pu	117,391	agr	4,052	3.41%
28	Brazil	BRA	12,473	0.111	pu	111,923	wrt	4,098	0.44%
29	Bolivia	BOL	6,670	0.137	min	121,265	con	2,165	0.88%
Africa									
30	South Africa	ZAF	35,760	0.074	pu	91,210	con	10,558	0.63%
31	Mauritius	MUS	35,381	0.058	pu	137,203	agr	24,795	3.44%
32	Nigeria	NGA	4,926	0.224	min	866,646	cspsgs	264	2.28%
33	Senegal	SEN	4,402	0.178	fire	297,533	agr	1,271	0.47%
34	Kenya	KEN	3,707	0.158	pu	73,937	wrt	1,601	-1.22%
35	Ghana	GHA	3,280	0.132	pu	47,302	wrt	1,507	1.05%
36	Zambia	ZMB	2,643	0.142	fire	47,727	agr	575	-0.32%
37	Ethiopia	ETH	2,287	0.154	fire	76,016	agr	1,329	1.87%
38	Malawi	MWI	1,354	0.176	min	70,846	agr	521	-0.47%

Note: All numbers are for 2005 unless otherwise stated.
* 2000 PPP $US. All numbers are for 2005 unless otherwise stated.

Table 1: Coverage Ratios UNIDO-EETD Manufacturing Employment. Figure taken De Vries (2015).

What was different in the African region in 1990-2005 in comparison to 1960-1975? To answer this we will use a further decomposed form of the productivity growth composition equation previously discussed.

If we refer to Figure 14 below we can see that through the different periods Africa experienced the following changes. From 1960 to 1975, static relocation gains were significant at 1.7% . Dynamic losses were small at -0.4% and dynamic gains were large at 1.6%. For context, labor was moving from agriculture to manufacturing, where productivity levels were significantly higher, and were not in decline relative to the rest of the economy, hence the small negative dynamic effect. The negative dynamic reallocation effect is a product of the increase in productivity in agriculture when workers exit the sector with a simultaneous decrease of labor share in that sector. So it is not a necessary negative performance indicator, the problem is when it is too large, as we will see in the next periods analyzed. Overall aggregate productivity growth was +2.9% in the period!

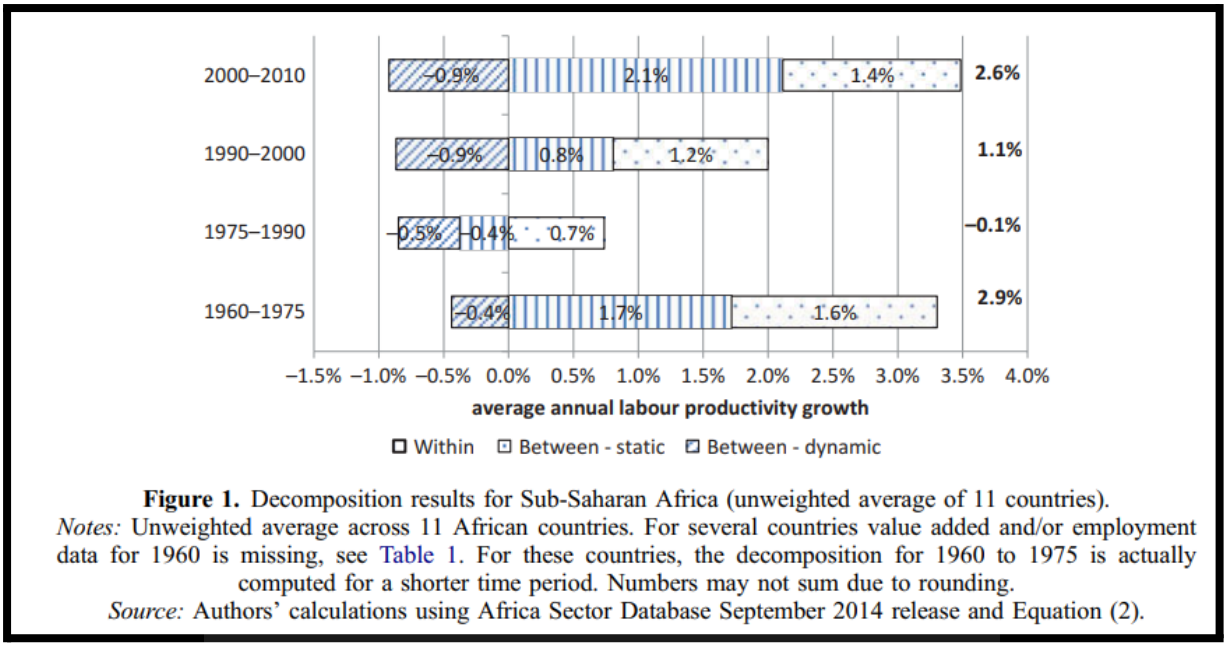


Figure 1. Decomposition results for Sub-Saharan Africa (unweighted average of 11 countries).
Notes: Unweighted average across 11 African countries. For several countries value added and/or employment data for 1960 is missing, see Table 1. For these countries, the decomposition for 1960 to 1975 is actually computed for a shorter time period. Numbers may not sum due to rounding.
Source: Authors' calculations using Africa Sector Database September 2014 release and Equation (2).

Figure 14: Decomposition Results for Sub-Saharan Africa. Figure taken from De Vries (2015).

From 1975 up to 1990 economic growth and structural change in the region stagnated. Within growth was still positive but considerably lower at 0.7%. Between static labor productivity growth was negative at 0.4% and between dynamic growth was negative too at -0.5%. Overall aggregate productivity growth was -0.1% in the reviewed period.

From 1990 up to 2005 structural transformation finally resurfaced, bringing workers out of agriculture at an accelerated pace and even out of industry, as we can see in the slight decrease in the labor share the manufacturing sector has allocated in the period. The sector that expanded was the services sector. Going from 12.8% of the labor force to 23.4% in 2010. Because the average productivity in the services sector was above average, the labor productivity between sectors static gains were positive, but because the marginal productivity of labor in the sector was very low, this contributed to negative dynamic gains in labor productivity at around -0.9%.

Seeing below Figure 15, when looking at Asia and Latin America the pattern too becomes clear, the period when the three regions trended similarly was in the 1960-1975 period. Coincidentally the African and Latin American region's openness to the world was more restrained and the countries managed to protect their manufacturing sector labor share, through protectionist policies if need be. After the stagnation for Africa and Latin America in the 1975-1990 period, when growth resumed and openness was pursued in all three regions, the difference was that while Africa and Latin America expanded the labor share of sectors that brought static gains but that suffered productivity growth decelerations, this is the service led structural transformation. Asia on the other hand expanded sectors with an accelerating productivity growth and hence got different results.

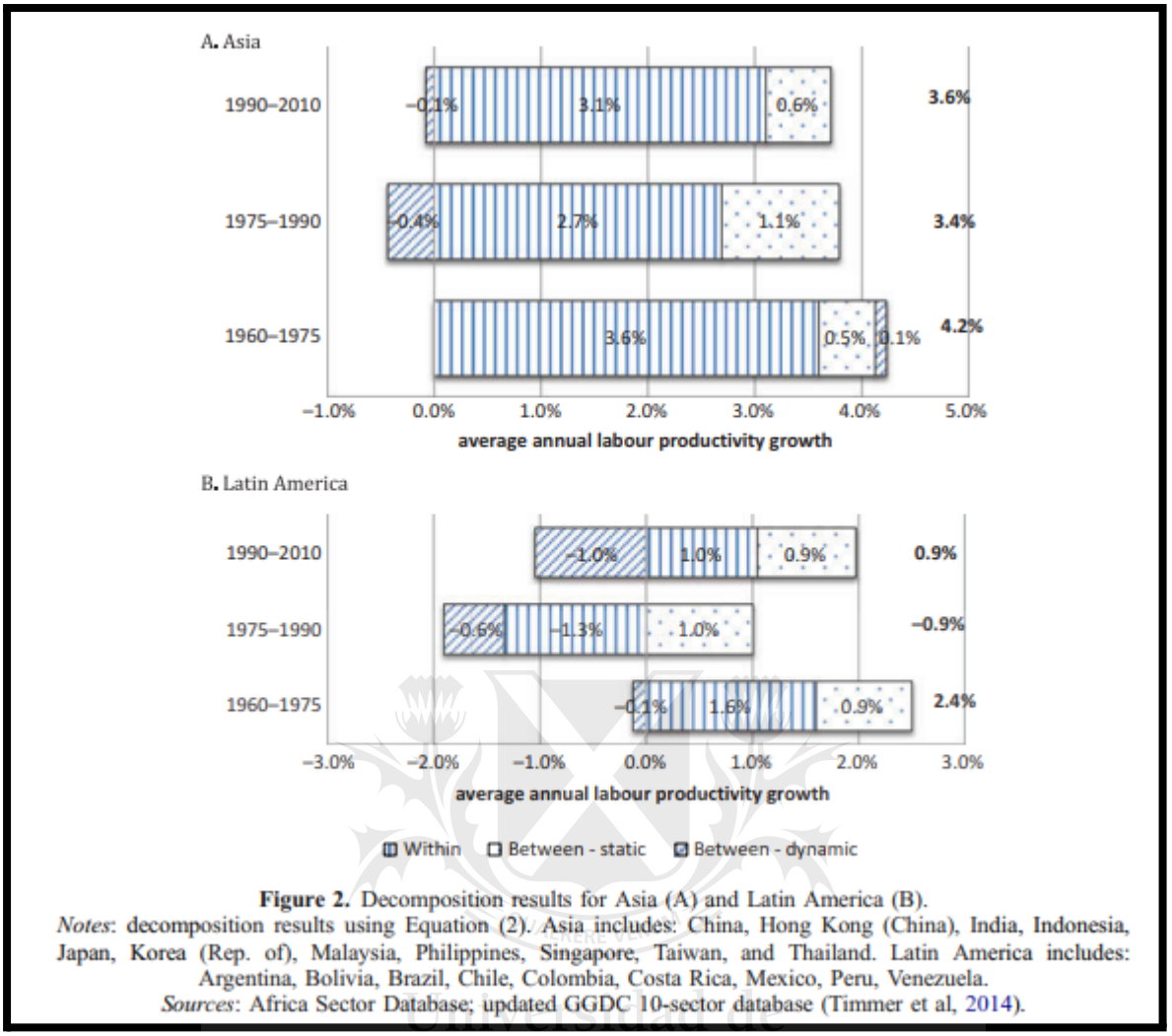


Figure 2. Decomposition results for Asia (A) and Latin America (B).
Notes: decomposition results using Equation (2). Asia includes: China, Hong Kong (China), India, Indonesia, Japan, Korea (Rep. of), Malaysia, Philippines, Singapore, Taiwan, and Thailand. Latin America includes: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Venezuela.
Sources: Africa Sector Database; updated GGDC 10-sector database (Timmer et al, 2014).

Figure 15: Decomposition results for Asia and Latin America. Figure taken from De Vries (2015).

This both reconciles McMillan's and Herrendorf,Rogerson and Valentinyi results and also suggests that manufacturing is the sector to which labor should be relocated, not services. Even though the three regions expanded the services sector after 1990, as we saw in our stylized facts section, it was only the Asian economy that also expanded the manufacturing sector and neutralized the negative dynamic *structural change* component of aggregate productivity variation that the services sector brought.

Regarding the second premise; that suggests that one possible special feature that might make manufacturing worth moving labor towards is that its productivity unconditionally converges to the frontier. On this topic we will first see Rodrik's (2013) findings. Rodrik found that there was indeed unconditional convergence in manufacturing. Looking at manufacturing industries among a set of 118 countries he saw unconditional convergence among these industries.

Below in Figure 16 we can see the unconditional beta convergence among manufacturing industries, for example industrial components manufacturing and pre-packaged edible goods manufacturing, where each point in the scatter plot is the manufacturing productivity for a manufacturing industry in a country in a base year and its growth rate in the subsequent 10 years.

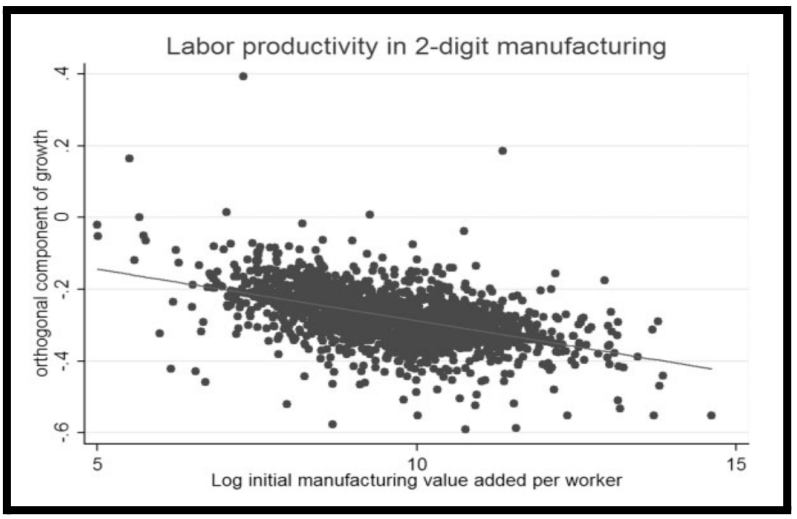


Figure 16: Labor productivity in 2-digit manufacturing (ISIC Industry standard identification). Figure taken from Rodrik (2013).

This unconditional convergence is also evident at the manufacturing in the aggregate level for each country in the database used by Rodrik. See below Figure 17.

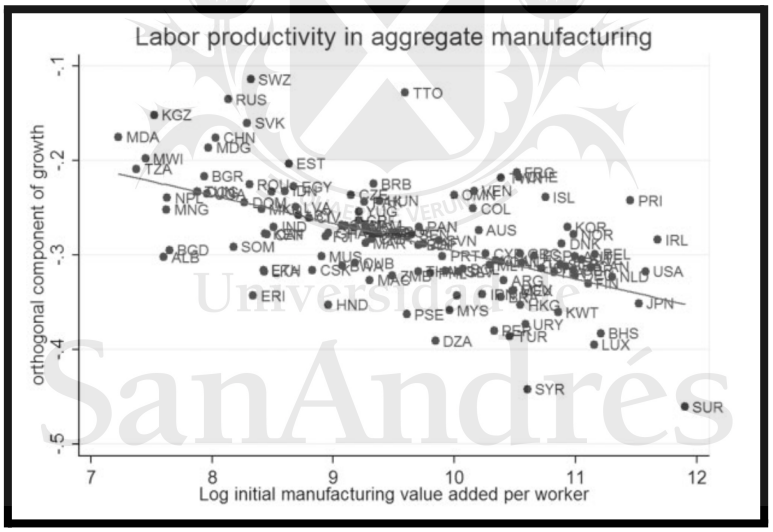


Figure 17: Labor productivity in aggregate manufacturing. Figure taken from Rodrik (2013).

It is also known that despite this phenomenon in manufacturing, aggregate productivity for all industries does not unconditionally converge[5], because manufacturing is still a small part of the employment in most countries and industrialization is not accelerating in most poor countries, meaning that manufacturing is not trending to become a larger part of the economy in this underdeveloped economies, thus favoring a structural transformation that incentivizes manufacturing employment would be wise under the assumption of unconditional convergence in manufacturing.

However, there is a footnote on Rodrik's findings previously highlighted. The database used to reach those conclusions is the UNIDO database that covers employment and value added data only for a specific type of firm. There is a bias in the selection of companies with which this database was completed, this is they only used formal operations, and formal operations industries might have a

[5] Subramanian, Arvind (2011, chapter 4)

different functioning pattern regarding their productivity. This is not to say that those findings are wrong, only that they need to be understood as findings that only apply when referring to manufacturing productivity of a specific type of firm, this is formal operations firms and what that might convey.

This footnote leads to Herrendorf,Rogerson and Valentinyi concluding on manufacturing having no evidence of unconditional convergence. To more effectively show the difference the selection bias makes and posit their refutal, using the Table 2 below we will show the beta convergence results for a subset of countries in the UNIDO database used by Rodrik in the period from 1995-2005 and compare it with the beta convergence for the same countries and time period but using the Extended Economic Transformation Database used by Herrenford, Rogerson and Valentinyi (2022) for productivity and value added data, it clearly shows that the subset of firms accounted for in the UNIDO database do show statistically significant unconditional convergence while the EETD does not show significant effects:

Table 11: Convergence Regressions for Manufacturing in Current USD Prices, EETD versus UNIDO (41 countries in EETD ∩ UNIDO, 1995–2005)

	EETD	UNIDO
β	−0.007	−0.020
	(0.005)	(0.006)
Number of observations	410	
Units	Current prices in USD	
Time fixed effects	Yes	
Country fixed effects	No	

Standard errors clustered at country level are in parentheses.

Table 2: Convergence Regressions for Manufacturing in Current USD prices. Figure taken from Herrendorf, Rogerson and Valentinyi (2022).

The EETD database does not have the selection bias the UNIDO database has. If we look at countries with data present in both databases through the whole 1990-2018 period (30 countries), the ratio of employment data in UNIDO to employment data in EETD shows the lack of coverage of the latter, 13 out of the 30 countries that overlap in both databases in the 1990 from 2018 period have less than 50 % of the employment and value added data covered in UNIDO relative to EETD, see below Table 3.

Table 12: Coverage Ratios UNIDO–EETD Manufacturing Employment
(30 countries in EETD ∩ UNIDO, 1990–2018)

UNIDO Employment / EETD Employment	0–0.25	0.25–0.50	0.50–0.75	0.75–1.00
Number of Countries	2	11	11	6

Table 3: Coverage Ratios UNIDO-EETD Manufacturing Employment. Figure taken from Herrendorf, Rogerson and Valentinyi (2022).

These two findings don´t contradict each other. This is, while manufacturing overall might not unconditionally converge there is a subset within manufacturing that does converge. To better conclude on the second premise on unconditional convergence we will refer to a paper by Dasgupta and Singh (2007) where they analyze India's manufacturing sector and the jobless growth it has been experiencing.

India is an example of an economy that has been going through continual expansion in GDP but its unemployment has grown as well. It is an economy that has been experiencing jobless growth.This fall in employment however has been mainly in the sectors with the largest share of employment; for example agricultural, mining and electricity[6]. While in the manufacturing sector, as Dashupta says:

"...the organized manufacturing sector has had almost no growth in employment during the post reform period (0.87 per cent). Therefore the bulk of employment increase in manufacturing has been in the informal (or unregistered) manufacturing sector (2.95 per cent). Along with employment, GDP in the informal manufacturing sector also rose at 8.66 per cent. In contrast GDP in the organized or formal manufacturing sector, which has had almost no employment growth, increased to 7.31 per cent"

This firstly implies an expansion of the informal sector, and an enormous increase in the productivity of the formal manufacturing sector. This is that while the formal manufacturing sector is the one with the larger sustainable productivity gains, that is generating technical advancements that increase productivity, it can not incorporate the number of employees fleeing low productivity sectors such as public utilities and agriculture. Nevertheless the informal manufacturing sector has been incorporating this labor in a more productive manner while also achieving sustained productivity growth.

Even though the productivity growth is not as impressive as the one in the formal sector, it is still enough for the *dynamic* component of productivity variation with labor to be positive. What is more, this speaks with Rodriks results of unconditional convergence in manufacturing in the formal sector but not in the informal one. The formal sector is the one achieving the accelerated and superior productivity growth but nevertheless must have some bottleneck that prevents it from absorbing labor. This might be the level of human capital development required to participate in said industry, or some other reason that is not present in the more accessible informal manufacturing sector that according to the authors is composed mainly of garment manufacturers and small but expanding informal family operations.

What is more, when Kaldor's first law is tested for the manufacturing sector and each group within it (formal or informal) in India using state-level data, we see the following. See Table 4 below.

[6] Dasgupta (2007)

Table 4: Relationship between state GDP growth and growth in manufacturing sector

	All manufacturing	Formal manufacturing	Informal manufacturing
Constant	0.36 (4.205)	0.45 (6.05)	0.30 (5.62)
Coefficient	0.61 (2.684)	0.45 (1.754)	0.75 (3.92)
R-square	0.32	0.14	0.53
F test	7.204	3.078	15.441
F (Ramsey)	4.36	3.35	5.12
Ho: model has no omitted variables			
No. of observations	14	14	14

Note: It is assumed that informal manufacturing is the same as unregistered manufacturing.

Eqn. used is Growth (State GDP) = $a + b_1$ (Growth Sectoral VA) + u_i

Source: Authors' estimation, based on data in Government of India, Central Statistical Organisation, National Accounts Statistics.

Table 4: Relationship between State GDP growth and growth in the manufacturing sector in India. Taken from Dasgupta and Singh 2007.

The table above shows us that the relationship between the growth in the overall manufacturing sector and the state GDP growth is positive and significant. For the unregistered sector as well. For the formal manufacturing sector the Beta coefficient is not significant at the 10% level.

So we found that the two premises brought forward to discredit manufacturing as the first step towards development by Herrendorf, Rogerson and Valentinyi are not so conclusive after all. We saw that the differentiating factor between Asia's experience with globalization and Latin America's and Africa's experience with globalization was that Asia increased their labor share in manufacturing and Latin America and Africa decreased their share in manufacturing, and all three regions increased their share in services. The problem with decreasing the share in manufacturing seems to be that there was no positive *dynamic* productivity change in aggregate productivity to pair against the negative *dynamic* productivity change brought by the increase in labor in services. With regard to the unconditional convergence claims, we found that while it is true that this are only valid in the formal manufacturing sector, countries such as India achieved to increase their aggregate labor productivity through moving labor into manufacturing even though their formal manufacturing was experiencing *jobless growth.* This is because they have, as we saw, a thriving informal manufacturing sector, that even though its productivity did not grow as impressively fast as the formal counterpart, still grew as its employment grew.

Nevertheless, we still are to review one more interesting point. This is the second objective of this section, to see the validity of Kaldor's laws in developing countries. This is important because these are the argumentative means through which manufacturing is defended as the first step towards development when moving labor out of agriculture.

Dasgupta and Sigh (2007) tested these laws in their work titled: *"Manufacturing, Services and Premature Deindustrialization"*. They tested them using 48 random developing countries, the maximum for which he could obtain usable data, from the period spanning from 1990 up to 2007.

Kaldor's first law states that the faster the rate of manufacturing sector growth, the faster the rate of growth of the whole economic system. Below, in Table 5, we have the model and its results.

Equation 1

gGDP = 0.022 + 0.473 gManf.VA R^2 = 0.9833

(13.98) (67.53) $F_{Stat}(1,46)$ = 2710.01

Diagnostic Tests			Critical Values
Functional Form F(1, 44)	0.90	<	9.71
Normality JB Test ~ CHSQ (2)	0.79	<	5.99
Heteroscedasticity CHSQ (2)	0.17	<	3.84
No. of observations	48		

Table 5: Equation 1, growth in manufacturing value added as a determinant for growth in gross domestic product. Figure taken from Dasgupta (2007).

The model has a beta coefficient of about 0.5, which suggests that the greater the difference between manufacturing growth and GDP growth, the greater the GDP growth. If we run the same analysis for the agriculture and services sector we find the following results, see Table 6 and 7 respectively below.

Will all the relevant diagnostic tests perform poorly, the beta coefficient for agriculture is 1.42, which would mean that an underperformance of agriculture sector growth regarding the economy's gdp growth would signal high gdp growth levels.

Equation 2

gGDP = 0.167 + 1.421 gAgr.VA R^2 = 0.6966

(2.31) (10.44) $F_{Stat}(1,46)$ = 108.92

Diagnostic Tests			Critical Values
Functional Form F(1, 44)	30.63	>	9.71
Normality JB Test ~ CHSQ (2)	14.33	>	5.99
Heteroscedasticity CHSQ (2)	11.89	>	3.84
No. of observations	48		

Table 6: Equation 1, growth in agriculture value added as a determinant for growth in gross domestic product. Figure taken from Dasgupta (2007).

The results for the services sector are much more competitive. With the diagnostics tests performing well, the model provides a beta coefficient of 0.58 which while lower than 1 (which would mean that services sector's overperformance of the economy signals high gdp growth) is still higher than the manufacturing sector's coefficient.

As Dasgupta and Singh note, a defense on Kaldor would be that while yes, the model suggests services as an engine for economic growth in a less potent way than manufacturing, this correlation might only be because both variables are caused by the manufacturing sector growth. This is to say that while a factory cleaning service might be very productive and growing faster than manufacturing, it still depends on the expansion of manufacturing for its own expansion.

Equation 3

gGDP = 0.015 + 0. 58g Ser.VA R^2 = 0.9811
(8.53) (48.85) $F_{Stat}(1,46)$ = 1576.34

Diagnostic Tests			Critical Values
Functional Form F(1, 44)	7.12	<	251.0
Normality JB Test ~ CHSQ (2)	3.85	<	5.99
Heteroscedasticity CHSQ (2)	1.04	<	3.84
No. of observations	48		

Table 7: Equation 1, growth in services value added as a determinant for growth in gross domestic product. Figure taken from Dasgupta (2007).

Kaldor's second law states that there is a positive relationship between the growth of the manufacturing sector and manufacturing productivity growth; this is because the increase in market size allows for further specialization that then further increases productivity. Its third law states that aggregate productivity growth is positively related with growth in employment in manufacturing, while negatively related with growth in employment in other non-manufacturing sectors.

Together they state that the growth in manufacturing value added causes growth in aggregate productivity. This is because if we increase employment in manufacturing, with positive marginal returns, the value added expands and according to the second law, this allows for further specialization which in turns increases manufacturing productivity. With the manufacturing sector absorbing labor and increasing its productivity, the gain is doubled because there are dynamic structural transformation productivity gains, the labor that leaves agriculture makes the agricultural sector more productive than before. The law, though is not stated only in respect to agriculture, it talks about the reduction in employment in non manufacturing activities. Thus the first test of the law is the following, see below the Table 8.

Equation 4

gProductivity = 0.0162 + 0.4984g Manf.VA – 0.7054gNon Manf.Emp R^2 = 0.9701
(3.71) (22.62) (10.93) $F_{Stat}(1,46) = 731.69$

Diagnostic Tests				Critical Values
Functional Form	F(1, 44)	4.57	<	9.71
Normality	JB Test ~ CHSQ (2)	167.2	>	5.99
Heteroscedasticity	CHSQ (2)	0.06	<	3.84
No. of observations		48		

Table 8: Equation 1, growth in manufacturing value added and growth in non manufacturing employment as a determinant for growth in aggregate productivity. Figure taken from Dasgupta (2007).

Its performance is according to what the theory would predict, however, the diagnostic tests are not sufficient. If we replace growth in non-manufacturing employment with growth in manufacturing employment the test performance is even better and the diagnostic tests are passed with flying colors, see Table 9 below.

Equation 5

gProductivity = 0.003 + 0.4087g Manf.VA – 0.286g Agri.Emp R^2 = 0.7641
(0.526) (5.18) (8.96) $F_{Stat}(1,40) = 63.51$

Diagnostic Tests				Critical Values
Functional Form	F(1, 38)	4.0	<	4.08
Normality	JB Test ~ CHSQ (2)	1.25	<	5.99
Heteroscedasticity	F(1,40)	0.852	<	4.08

Table 9: Equation 1, growth in manufacturing value added and growth in agricultural employment as a determinant for growth in aggregate productivity. Figure taken from Dasgupta (2007).

We can observe what happens with the services sector, does it pass the test? If so we might have to consider it a contestant as an engine of growth. It suggests that services, like manufacturing, contribute to a growth in productivity as manufacturing does, although in a less potent way. See Table 10 below.

Equation 6

gProductivity = -0.0207 + 0.9059g Ser.VA – 0.276g Agri.Emp $R^2 = 0.8259$

(3.09) (7.09) (10.04) $F_{Stat}(1,40) = 92.51$

Diagnostic Tests				Critical Values
Functional Form	F(1, 38)	8.09	>	4.08
Normality	JB Test ~ CHSQ (2)	6.53	>	5.99
Heteroscedasticity	F(1,40)	0.382	<	4.08

Table 10: Equation 1, growth in services value added and growth in agricultural employment as a determinant for growth in aggregate productivity. Figure taken from Dasgupta (2007).

To conclude we see that the validity of Kaldor's laws still stand for developing countries although with a footnote the impact of services is not negative it is positive and while less potent still relevant.

Overall it seems that while services are very important in achieving growth it is still a necessary condition to develop the manufacturing sector. We have seen indications of it in contrast with the structural transformation of Asia, which achieved modern economic growth and grew both manufacturing and services sectors at the expense of the agriculture sector, and Africa and Latin America, which shrunk the manufacturing sector together with the agricultural sector and only expanded the services sector and did not achieve modern economic growth. The testing of the services sector validity as an engine of growth according to Kaldor's laws seems to have shown that the manufacturing sector is still of a fundamental importance for modern economic growth and that the services sector can contribute to it too but it requires growth in the manufacturing sector as well.

Conclusions

We have found that there are different general patterns of structural transformation in Africa, Asia and Latin America. All the regions have expanded the services sector as they have increased their GDP per capita levels since 1990, as measured by an increase in the services sector share of value added All the regions seem to, mostly, have reduced the share of value added of Agriculture in their respective economies. Nevertheless, Asia seems to have been the only one region that expanded the manufacturing sector's share of value added as they have developed more.

This pattern of differences coincides as well with the fact that Asia has been the only region that has sustained modern economic growth, with sustained aggregate productivity growth, after the 1990s. In the literature we reviewed, we have found the explanation to this fact to be that, while the expansion of the services sector has brought upon static productivity gains, it has brought dynamic productivity losses and without a growing manufacturing sector those negative dynamic losses have had an impact on the aggregate productivity growth of those regions. Furthermore, we found that although unconditional convergence in manufacturing is only valid to formal manufacturing, countries like India, where there has been *jobless growth* in formal manufacturing but growth in informal and low skilled manufacturing, have still experience productivity growth in the informal sector, using it to move labor out of agriculture and extremely low productivity sector without having a negative dynamic component that impact aggregate productivity growth. Lastly, we have seen that Kaldor's Laws still stand for manufacturing in developing countries and that even though the services sector is now very relevant for development unlike the time in which those laws were formulated, it does not seem to bear a fundamental importance as the manufacturing sector does.

Future research should focus on understanding the different productivity levels within activities in the same sector to more clearly understand which activities are the actual engines of growth. Categorizations might have gotten outdated, with activities such as software, which is a form of machine engineering, being considered part of the services sector. It is not entirely clear that it should be. How would the view on the empirical validity of Kaldor's laws change if activities such as software development were considered part of the manufacturing sector? After all, one of Kaldor's Laws states that there is a positive causal relationship between the growth of the manufacturing sector and manufacturing productivity growth; this is because the increase in market size allows for further specialization that then further increases productivity and perfectly coincides with the way that software development behaves, the larger the market has become, the more specialization within it that has appeared.

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